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probably be five hundred years before abstract science can be supported here, from present indications.

This paper has been withheld from publication three years, as I earnestly desired to make full dissections of widely diverging genera, to fully corroborate the general law which may be said to have been arrived at both inductively and deductively. The pathology of insanity now claims my entire time, and I must leave to others the completion of what I have begun.

There have been occasional passages in medical journals which bore upon the subject of the significance of valves in the veins, but I believe that no one has anticipated me in the announcement of the influence which gravitation exerts upon the creation of these valves in quadrupeds, and that man's veins are valved in such manner as to place his derivation from a quadrupedal form beyond dispute. The deductions from mechanical influences made in this paper are original, and I cannot find that they have been elsewhere mentioned. Certainly the publication of so sweeping a statement as that pertaining to the valves would have attracted universal attention among comparative anatomists had it been made before, and eminent gentlemen in that field have confessed to me that the matter was new to them.

Besides its reading before the University Club, April 18, 1882, the substance of this paper was presented by me before the Philadelphia Academy of Natural Sciences last May, as noted in *AMERICAN NATURALIST*, September, 1883.

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THE MAMMALIAN FAUNA OF THE AUSTRALIAN DESERT.

BY EDWARD B. SANGER.

THE physical conditions of the interior of Australia are not such as to support a varied fauna. The mammals are few in number, and are principally those which are best adapted for dry and arid regions. But four orders of Mammalia are represented, viz: Cheiroptera, Rodentia, Carnivora and Marsupialia. The first named order is represented by *Scotophilus moris*, the chocolate bat. These animals are very numerous. They live in hollow trees, and fly around in great numbers about dusk. To the natives, who catch and eat them, they are known by the name of "*oolo-warra*." They are generally caught by chopping them out of the hollow trees in day time. This is the only species of bat that I observed in the interior. The Rodentia are represented by three genera and five species, viz: *Hapalotis conditor*, *H. mitchelli*, *H. cervina*, *Mus vellerosus*, *Hydromys fulvolovatus*.

Hapalotis conditor is the Australian building rat. It builds nests, among the sandhills near the creeks, of sticks, leaves, &c. The nest is very roughly constructed, and to a non-observing eye looks like a mere bunch of dry sticks. Inside it is lined with soft leaves and bits of grass. The entrance is a small hole on the

side. There is another mode of ingress or egress afforded by a tunnel burrowed by the rat from the floor of the structure underground to a distance of about three feet, when it rises to the surface in some clump of grass or small bush. This is evidently a mode of escape for the animal when surprised by aborigines or dingos (*Canis dingo*), which seem to be their only enemies. This rat is called "*kuckala*" by the natives, who prize them exceedingly as food.

H. mitchelli and *H. cervina* are both nocturnal jerboa rats. Their nests consist simply of a few leaves and bunches of grass raked together in some clump of bushes. The natives eat them and call them respectively "*arritchi*" and "*koolahroo*."

Mus vellerosus is a small rat which infests large tracts of country in droves during flood time. They migrate from place to place. Their well-beaten paths may often be seen winding through the sandhills, and sometimes the droves themselves. They are a great nuisance to the whites, as they eat up everything. Saddles, provisions and everything that can be hurt by an animal's teeth must be placed up in trees or stumps away from the ground when the nightly camp is made, or all will be destroyed before morning. The native (Dieyerie) name for them is "*miaroo*."

Hydromys fulvolovatus, the large Australian water rat, is common in all the prominent water holes on Cooper's creek. They live in holes in the banks, with one entrance opening under water and the other on the land. They live principally on roots, &c. The natives say that they kill and eat various water birds. I cannot say whether this is true or not, but I know that they will eat flesh. One day I shot some black swans (*Chenopsis atrata*) and left them, after securing the skins, on the bank of a water hole. The next day I went there, and as I approached the dead swans I saw two or three water rats run away from them and disappear in the water. The swans were half eaten up, and had been dragged several yards nearer the water. I determined to make sure whether the rats had eaten of them or whether it was the dingos. I seasoned them with some strychnine and the next day found two dead rats by them. I think it is very probable that they do catch and eat birds. They are very large and ferocious, and can bite severely. The natives are afraid of them.

The Carnivora are represented by *Canis dingo*. This dog is

abundant wherever there are any animals for it to prey upon. Hence in regions where there are cattle and sheep they are more numerous than in outlying districts. The settlers poison them by preparing baits treated with strychnine.

They do not travel or hunt in packs, but are solitary. Neither have they any fixed nest or den. In settled districts they are very shy, as might be expected; but in the remoter parts they are bolder, and I have known them carry off my boots at night time, which is very inconvenient in such regions. They are orange-yellow in color, and have a large bushy tail. In fact they are very handsome when pure blooded, *i. e.*, have not mixed with other dogs belonging to the whites. They make a very mournful noise, howling at night. I have never heard the wild ones bark; they howl and growl only. They eat any animal that they can catch, lizards even. The smaller and more sluggish animals are the ones which fall a prey to them, as the dogs are no match for the kangaroo or wallaby in swiftness; indeed, an adult kangaroo can easily kill them, so the dogs wisely leave them alone. It is very amusing to see one twisting and turning in pursuit of a sandhill wallaby (*Bettongia grayi*); the dog is generally beaten in the race. Sometimes, however, when the dog catches the wallaby napping, the laugh is on the other side. The natives tame these dogs and always have a great number of them around their camp. Though they are kept in a half-starved condition, the natives seem to be fond of them.

The dingos interbreed with dogs introduced by the whites. So common is this, indeed, that in the more settled districts a pure-blooded dingo is a rarity. They are universally distributed, being found in all parts of the continent, and do not seem to vary in character at all. The natives have no traditions concerning them, as far as I was able to learn.

The Marsupialia of the desert are represented by three families, viz: the Macropidæ, Peramelidæ and Phalangistidæ. In the first-named order the largest form found in the desert is *Osphranter rufus*, the common red kangaroo. The male is red and the female bluish-gray. This animal is but rarely seen, and only after a heavy rain, when there is plenty of vegetation for it to feed upon. Towards the confines of the desert it is more numerous.

Onychogalia lunata, the crescent-marked, nail-tailed kangaroo, is also rather uncommon, and is almost always found on the stony plains or tablelands.

Bettongia grayi, Gray's jerboa or the sandhill wallaby, is found among the sandhills, and is solitary in habit. I never saw two of them together. It is very swift and dexterous, dodging in and out among the bushes in a surprising manner.

Among the Peramelidæ we find *Perameles fasciatus* and *Pera-galea lagotis*, known respectively as the banded and the long-eared bandicoot. Both of them are found in the sandhill country.

Chæropus castanopus is also found, but it is rare.

Along the creeks, and especially where there are abundant water holes, phalangiers (*Phalangista*) are abundant, but of what species I am uncertain.

The above are all the mammals that I met during my two years' sojourn. When the country is better known more will probably be found. The number of forms depends greatly on the character of the season. After a rain animals visit the desert that are not known there at other times. Hence the conflicting reports received so often on the subject. With the exception of *Osphranter rufus* those mentioned above are true desert forms; that is, they are always found there. It is worthy of note that the Marsupialia, though furnishing the greatest number of species, are not the predominating order of mammals. The Rodentia preponderate in number and almost equal the former in species. This is a notable exception to the other parts of the continent. It is still more interesting to notice that two (the jerboas) of the four species of Rodentia remarkably resemble certain forms of the Marsupialia. Like physical conditions seem to tend to produce similar forms out of different types of animals. In other parts of the continent certain marsupials have developed into carnivores curiously resembling some forms among monodelphian Carnivora.

The mammals living at present in the desert are small, and are well adapted to the life they lead. When contrasted with the giant marsupials which once inhabited the region, and whose remains we now find here and there in it, we can see how much the character of the fauna depends on the constancy of the physical conditions of the region. Slight changes produce great results.